

1. (original) High compression ratio, homogeneous charge compression ignition/spark ignition dual mode engine comprising:

a first mode employing homogeneous charge compression ignition at low- and mid-load levels; and

a second mode employing spark ignition at high load levels, the second mode including the addition of hydrogen or a hydrogen/carbon monoxide mixture in the engine.
2. (original) The engine of claim 1 wherein the compression ratio is greater than about 10:1.
3. (original) The engine of claim 1 operating on a low octane gasoline.
4. (original) The engine of claim 1 wherein the addition of hydrogen or a hydrogen/carbon monoxide mixture is sufficient to prevent knock.
5. (original) The engine of claim 1 wherein the addition of hydrogen or a hydrogen/carbon monoxide mixture increases the fuel octane number by at least 10.
6. (original) The engine of claim 1 further including control means for changing engine mode.
7. (original) The engine of claim 1 wherein the engine operates on a very lean fuel-air mixture or at a stoichiometric fuel-air mixture with high EGR.
8. (original) The engine of claim 1 further including pressure boosting to increase engine power density.
9. (original) The engine of claim 8 wherein pressure boosting is by turbocharging or supercharging.
10. (original) The engine of claim 1 wherein the hydrogen or hydrogen/carbon monoxide mixture is produced by a hydrocarbon fuel reformer.
11. (original) The engine of claim 10 wherein the fuel reformer is a plasmatron reformer.
12. (original) The engine of claim 1 wherein the hydrogen is stored in a high pressure vessel

or other onboard storage means.

13. (original) The engine of claim 1 further including means for varying combustion rate by stratifying the hydrogen or the hydrogen/carbon monoxide mixture.
14. (original) The engine of claim 13 wherein stratifying the hydrogen or hydrogen/carbon monoxide mixture is achieved through non-uniform or time-varying port fueling or by in-cylinder injection.
15. (original) The engine of claim 1 further including means for slowing down the combustion process to reduce acoustic noise.
16. (original) The engine of claim 1 wherein the amount of the hydrogen or the hydrogen/carbon monoxide mixture is increased as engine load increases.
- 17-22 (cancelled).
23. (original) The engine of claim 12 wherein the power boosting is by turbocharging or supercharging.
24. (currently amended) High compression ratio, homogeneous charge compression ignition engine operating on a high cetane fuel along with the addition of hydrogen or a hydrogen/carbon monoxide mixture at low-to-mid-load levels. ~~The engine of claim 17~~ wherein hydrogen or hydrogen-carbon monoxide mixture is produced by a hydrocarbon fuel reformer.
25. (original) The engine of claim 24 wherein the fuel reformer is a plasmatron.
26. (currently amended) High compression ratio, homogeneous charge compression ignition engine operating on a high cetane fuel along with the addition of hydrogen or a hydrogen/carbon monoxide mixture at low-to-mid-load levels. ~~The engine of claim 17~~ wherein the hydrogen or hydrogen/carbon monoxide mixture is contained in a high pressure vessel or other onboard storage means.
27. (currently amended) High compression ratio, homogeneous charge compression ignition engine operating on a high cetane fuel along with the addition of hydrogen or a hydrogen/carbon monoxide mixture at low-to-mid-load levels. ~~The engine of claim 17~~ wherein the high cetane fuel is bio-oil.